

REMARKS

Status

This amendment is being submitted together with a Request for Continuing Examination (RCE) for the present application. In an Office Action mailed July 19, 2003, the application was subject to a final rejection. This amendment and remarks address points of that rejection.

The Prior Rejection

In the Office Action mailed July 19, 2003, claims 1-4, 6-7 and 9 were rejected under 37 USC 103 as being unpatentable over U.S. Patent No. 6,199,000 of Keller in view of U.S. Patent No. 4,967,362 of Schutten, U.S. Patent No. 4,398,195 of Dano and U.S. Patent No. 5,928,309 of Korver. Claims 4 and 6 were also rejected under 35 USC 103 as being unpatentable over '000, '362, '195, and '309, further in view of U.S. Patent No. 6,087,984. Claims 10-11 were rejected over the foregoing art further in view of U.S. Patent No. 6,314,348. Claim 12 was rejected under 35 USC 103 over the foregoing art and further in view of U.S. Patent No. 6,400,143.

The Amended Claims are Allowable Over the Prior Art

In the Office Action, the Examiner has contended that the invention as claimed in any of claims 1-4, 6, 7, and 9-12 is obvious in light of certain combinations of references. The Applicant does not agree.

The Applicant has submitted in the first response that it was not obvious at the time of making the invention to combine relative position determining means with a GPS receiver into an apparatus for guiding an agricultural vehicle. The basic patent application was filed on 27 October 1998 in Australia. Around the time the invention was made, GPS based positioning systems utilizing correction data from a base station (two examples being, differential GPS correction and real time kinematic correction as described in the '000

principal citation) were known. In particular, real time kinematic corrected GPS receivers provided an extremely high level of accuracy which in some cases was less than 10cm. The Applicant has argued that, although corrected GPS position data was capable of pinpointing the instantaneous location of an object to a high degree of accuracy, in the case of an object in motion, such as an agricultural vehicle, the system cannot provide the same accuracy in respect of the position of the object in relation to a path, thus limiting the ability to correct the actual path of the object. The source of the limitation of accuracy in following a path arises as a consequence of the speed of the vehicle and the inherent position-update frequency of the GPS system.

The Applicant explicitly acknowledges that the combination of GPS per se and a dead reckoning system is used by aircraft and the like; these systems comprise a GPS (with its inherent update frequency) imposing position corrections to, for example a high-precision inertial navigation system (with its inherent drift over a longer timeframe than the GPS update time).

Inertial navigation systems have been used with GPS systems, however they were either used to correct the GPS data itself (where a highly accurate inertial navigation system would be required) or were used to provide approximate position data when GPS satellites were out of range (such as in the aircraft example above). The Applicant has argued that the invention as claimed combines a correction data receiving GPS receiver with relative position determining means to calculate position data for time periods between when GPS updates are received. This combination of a fairly "low end" relative position determining means (such as a low end inertial navigation system based on accelerometers) and a "high end" GPS system has resulted in a product of improved accuracy and performance about a path, that was unexpected in light of the teachings of the prior art formerly cited.

As the Applicant has argued, there is a particular synergy between highly accurate though periodic GPS readings, the "low end" inertial navigation system, the guidance means and the processor of the Applicant's system that produced a result that was unexpected in light of prior art. Essentially, prior art agricultural systems employing a GPS receiver and guidance means only allowed for "discrete" corrections to the vehicle path upon the receipt of each update of GPS position data. In contrast, the elements of the Applicant's system allow for a continuous process of position determination and path correction. In fact, the controllable steering means (claimed in current claim 7) was specifically developed to automate the process of path correction, as it was found that a human operator could not provide sufficient steering accuracy to fully exploit the guidance capabilities of the system, as opposed to Keller et al. U.S. 6,199,000, which uses operator steering.

Because a fairly "low end" inertial navigation system can be used with the Applicant's invention, (unlike some of the prior art systems, as will be discussed below) the unit cost is far lower, and has thus enabled more widespread adoption of GPS technology in agricultural endeavors than was possible with prior art systems. Thus the Applicant's invention has advanced contemporary expectations and lowered the cost of products of this kind.

Keller et al. US 6,199,000

The basic prior art document used by the Examiner is Keller et al., on which the obviousness of all of the claims has been asserted when combined with other documents.

The Keller et al. patent broadly describes a system that relies on Real Time Kinematic (RTK) GPS to guide (through the medium of an operator responding to a display of deviation) a vehicle over terrain by reference to a digital map of the terrain. The citation discloses the use of accelerometers to provide pitch, yaw and roll corrections for seeder embodiments to enable centimeter accuracy of seed placement (col. 7 lines 15 to 23) by relative movement of the seeder heads on the vehicle. The accelerometers do not provide for

steering correction of the vehicle per se, the track accuracy of which computes vehicle paths using an existing vehicle path (which has been calculated with downloaded GPS data) and real time path information (which is manually entered by an operator).

Keller et al. immediately teaches away from the invention claimed by the Applicant, in that there is no need for the calculation of position data between RTK GPS updates. The basis behind the Keller et al. system is to take into account real time events such as the navigation around obstacles. Position data between GPS updates is not required as it could very well be overridden by the actions in operator response to real time data. There is thus no motivation to alter Keller et al. to include low end relative position determining means to maintain a track between high-end GPS updates, as provided in the invention as claimed.

Schutten et al. US 4,967,362

The Examiner considers that the '362 patent provides the basis for the feature of "relative position determining (means) for generating relative positional data signals applicable to time periods between receipt of vehicle position data", and refers to a very large part of the description without close identification of the relevant part of that description. The Applicant cannot see the relevance of this citation. The course "correction" described is correction of course relative to features of the terrain, to wit, corn rows. The contact-type sensors form part of the primary guidance; they do not provide correction for the primary guidance. Such an arrangement is incapable of supplementing a GPS system to provide guidance between GPS updates relative to a predetermined base map.

Dano US 4,398,195

The Examiner considers that the '195 patent provides the basis for the feature of data entry facilitating entry of an initial path and a desired offset between paths. Again the Examiner refers to a very large part of the description without close identification of the relevant part of that description. The Applicant again cannot determine the relevance of this

citation. The specification of an initial path and an offset between paths is something that a farmer does manually in a completely different context to the present invention. The '195 disclosure similarly generates aircraft-compatible display that enables a pilot to manually fly the aircraft over the desired initial and subsequent tracks. There is nothing in the disclosure that would add anything to the '000 patent, the operation of which implies that there is an initial track and subsequent tracks if it is to be useful. The citation does not, either alone or in combination with the '000 patent, foreshadow the integration of this ordinary information with means for combining high-end GPS data with low-end relative position data to provide continuous self steering control over those initial and subsequent tracks for an agricultural implement.

Korver et al. US 5,928,309

The Examiner considers that the '309 patent provides the basis for the feature of "combining the corrected vehicle position and relative position data and guiding the vehicle towards paths". Again the Examiner refers to a very large part of the description (col. 2 to col. 6) without close identification of the relevant part of that description. The Applicant again cannot determine the relevance of this citation, given that the Korver system uses an inertial guidance system as the navigation baseline, updated by GPS to account for drift of the inertial system and serving in combination to steer the vehicle along a desired track, rack correction, whereas the present system uses high-end GPS data to provide definitive positioning relative to a given initial track and offset tracks, with the navigation of the vehicle between GPS updates being provided by low-end inertial system, for which drift is largely irrelevant over the GPS update timeframes.

It will thus be seen that the invention, as now claimed, defines subject matter which is neither shown nor suggested in the prior art. In fact, the Keller '000 patent, as described above, explicitly teaches away from the presently claimed invention insofar as it teaches that

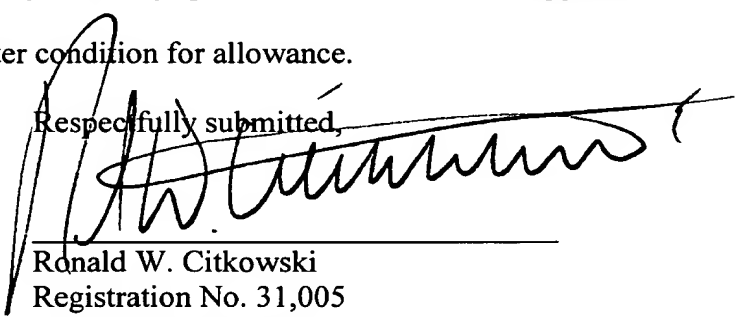
there is no need for the calculation of position data between RTK and GPS updates. Furthermore, there is no motivation to alter the system of Keller so as to approximate the presently claimed invention. Thus, Applicant respectfully submits that the claims as now amended define the subject matter which is patentable over all of the prior art of record.

Conclusion

By the present response, Applicant has amended the claims to recite the use of accelerometers to provide low end inertial guidance between GPS updates in the system of the present invention. Applicant has also further amended the claims to address various issues of clarity. Applicant has also presented remarks detailing how and why the amended claims overcome the rejections.

The application is now in condition for allowance. The Examiner is respectfully requested to contact the undersigned attorney with any questions, comments or suggestions which may place the application in still better condition for allowance.

Respectfully submitted,



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